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The Ratoon Stunting Disease of Sugarcane

and its control in Florida

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CONTENTS

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THE RATOON STUNTING DISEASE OF SUGARCANE AND ITS CONTROL IN FLORIDA

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The ratoon stunting disease of sugarcane (RSD), caused by a virus, was first recognized in Queensland, Australia, during the 1944-45 crop. In 1949 the disease was formally reported from Australia by Mungomery (8).[2/] Since that time RSD has been discovered in all of the important sugarcane areas throughout the world and is firmly established as one of the major diseases of the crop. The ratoon stunting disease is now considered an important factor in the failure or "running out" of varieties of sugarcane (7). This has been confirmed by extensive studies which have revealed staggering losses in the yield of cane of certain varieties. These losses have been attributed directly to RSD (6, 10).

SYMPTOMS

The lack of specific external symptoms on infected plants undoubtedly explains why RSD was not recognized earlier, and worldwide distribution of the disease was reached long before its discovery. As the name of the disease implies, growth is retarded and the plants are stunted (Figure 1). This phenomenon has been found to occur not only in the ratoon or stubble crop of many varieties, but in the plant cane crop as well. Growth retardation, however, may be caused by other factors and therefore hardly can be considered as diagnostic.

The ratoon stunting disease is usually detected by the presence of rusty-orange colored fibrovascular bundles in the nodal region of infected stalks. This color varies in shade and intensity among varieties. Diagnosing RSD on the basis of nodal discoloration is difficult and not always entirely satisfactory. For this reason many workers have searched for a more reliable and rapid means of identifying the disease (1, 2, 4, 5, 11). Unfortunately, only limited progress in this direction has been made, although each contribution has increased the general knowledge of this little-known and complex virus disease of sugarcane.

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2/ Figures in parentheses refer to Literature Cited at end of this report.

The writer wishes to express his appreciation to Dr. I. E. Stokes and to Mr. C. O. Grassl, Research Agronomist and Botanist, respectively, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, for their assistance in the preparation of this manuscript.

Figure 1. Plant cane of F. 31-962 at Canal Point, Florida: Left, plant infected with the ratoon stunting disease; Right, healthy plant cane.

TRANSMISSION

The ratoon stunting disease is readily transmitted by the cane knife or the mechanical harvester. For experimental purposes, several other efficient methods of introducing the causal agent into healthy cuttings have been described (10). Seed pieces from infected stalks of cane give rise to diseased plants which in turn become sources of infection. This, then, is an extremely important means of RSD dissemination which emphasizes the need for appropriate control and sanitation measures in combatting the disease. There is no evidence that the ratoon stunting disease is carried by true seed (fuzz). Likewise, there is no indication that the virus persists in the soil.

LOSSES

In Florida the yields of the major commercial varieties of sugarcane are greatly reduced by RSD. These losses result largely from: (1) poor

germination of diseased seed cane resulting in fewer stalks in the plant cane crop; (2) suppressed germination and tillering of infected stools in subsequent stubble crops; and (3) stunted plant growth accompanied by slender stalks with shortened internodes. The degree to which these effects become apparent depends upon the susceptibility of the variety under observation and the environment under which the crop is produced. It has been found that the detrimental effects of RSD on plant growth are accentuated by unfavorable growing conditions such as drought, low fertility, and other factors not conducive to good growth.

The tabulation of yield data in Table 1 indicates differences between healthy and RSD-infected cane of 4 of the leading varieties of sugarcane in Florida. Differences in sucrose between diseased and healthy cane were not significant.

Table 1. The effect of the ratoon stunting disease on the yield of cane in Florida.

Test No.	Variety	Location	Soil type	Yield of first stubble cane (Tons per acre)		
				Diseased	Healthy	Percentage increase
1 (1956)	C.P. 34-79	Fellsmere	Sandy	17.6	21.9	24.4*
2 (1956)	F. 31-962	Okeelanta	Peat	22.7	31.8	40.0*
3 (1957)	Cl. 41-223	Okeelanta	Peat	41.5	49.5	19.3*
4 (1959)	C.P. 50-28	Fellsmere	Sandy	18.9	25.6	35.4**

* Significant at 5% level; ** Significant at 1% level.

CONTROL

Several investigators (9, 10, 12) have clearly demonstrated that the ratoon stunting disease can be effectively controlled by heat therapy with either hot air, as practiced in Louisiana and certain other areas, or hot water, as used in most countries. Differences between varieties in their tolerance to heat treatment have been observed; consequently, the temperature and duration of hot-water or hot-air treatments may vary slightly in different countries where these methods of RSD control are practiced.

At Canal Point, Florida, treatment with hot water at 51°C. for 2 hours or 50°C. for 2-1/2 hours is used and recommended for maximum control of RSD. Experience at this station has shown that better germination and disease control is obtained with hot water when the central part of 10- to 12-months-old cane is selected for treatment. The simplicity and accuracy of the hot water treatment favor the use of this method for controlling the disease; it has given very satisfactory control of RSD in hundreds of varieties of different species of worldwide origin that comprise the World Collection at Canal Point (Figure 2).

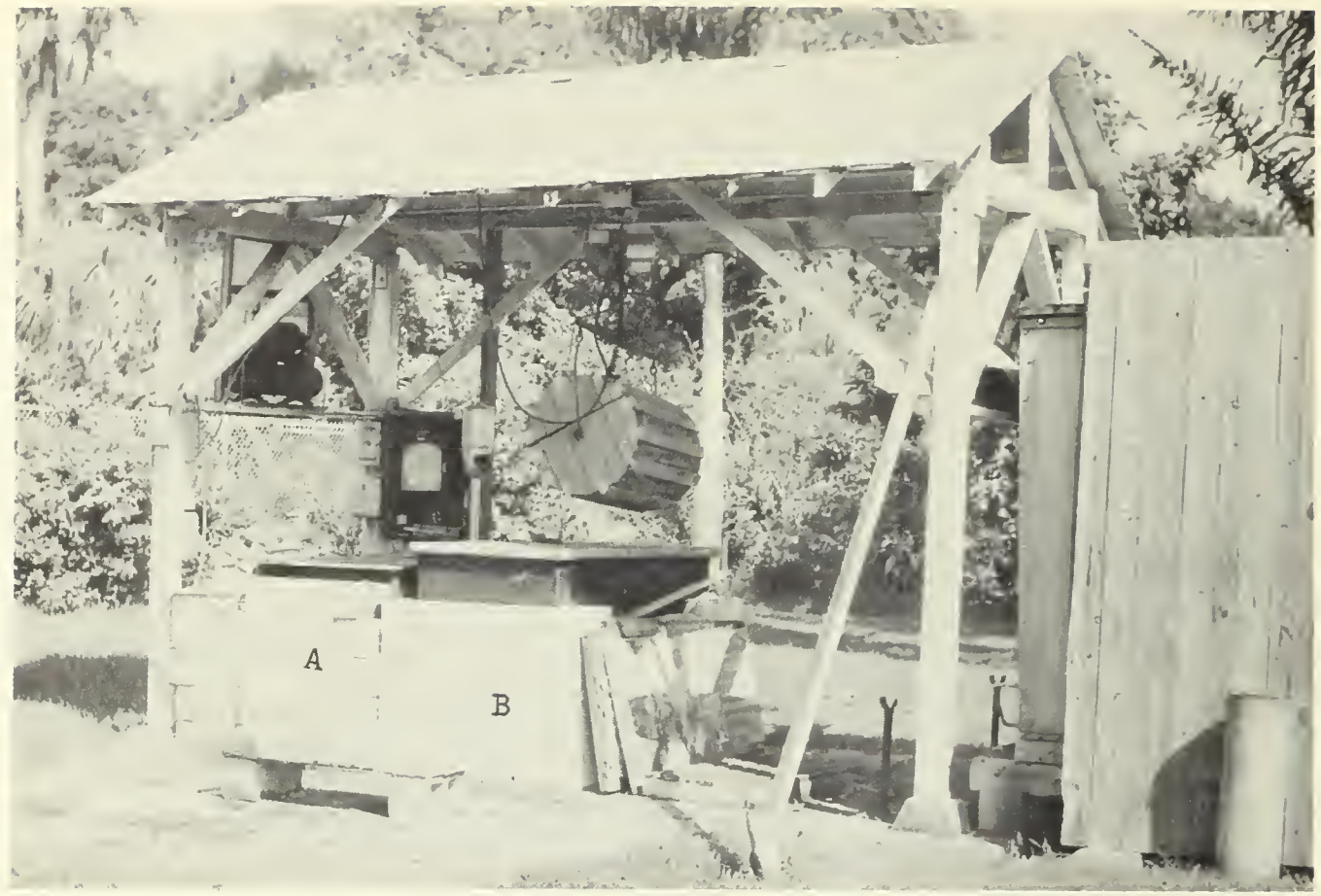

Figure 2. The electric water treating facility for ratoon stunting disease control at Canal Point. A, compact 260-gallon capacity hot-water treater; B, slightly larger auxillary tank presently being readied for use as a second treating unit.

HOT-WATER TREATMENT

The hot-water treatment for the control of RSD depends largely upon principles first described by Australian investigators (6). Temperature control and uniform distribution of heat throughout the treatment chamber must be maintained in order to realize effective control of the disease with minimum damage to the seed pieces. To implement the proper circulation of hot water, it is recommended that the proportion of water to seed cane be not less than 1 gallon of water for every pound of selected seed material. The fact should be recognized that it is necessary for every seed piece to receive the prescribed temperature for the duration of the treatment period. All possible hindrances to this accomplishment should be eliminated.

The initial temperature of the water in the tank should be such as to compensate for the cooling effect by the cane when it is lowered into the treater. Timing for the treatment period should begin at the time the cane is placed in the treater.

Details of the electric hot-water treater used at Canal Point are shown in Figure 3.

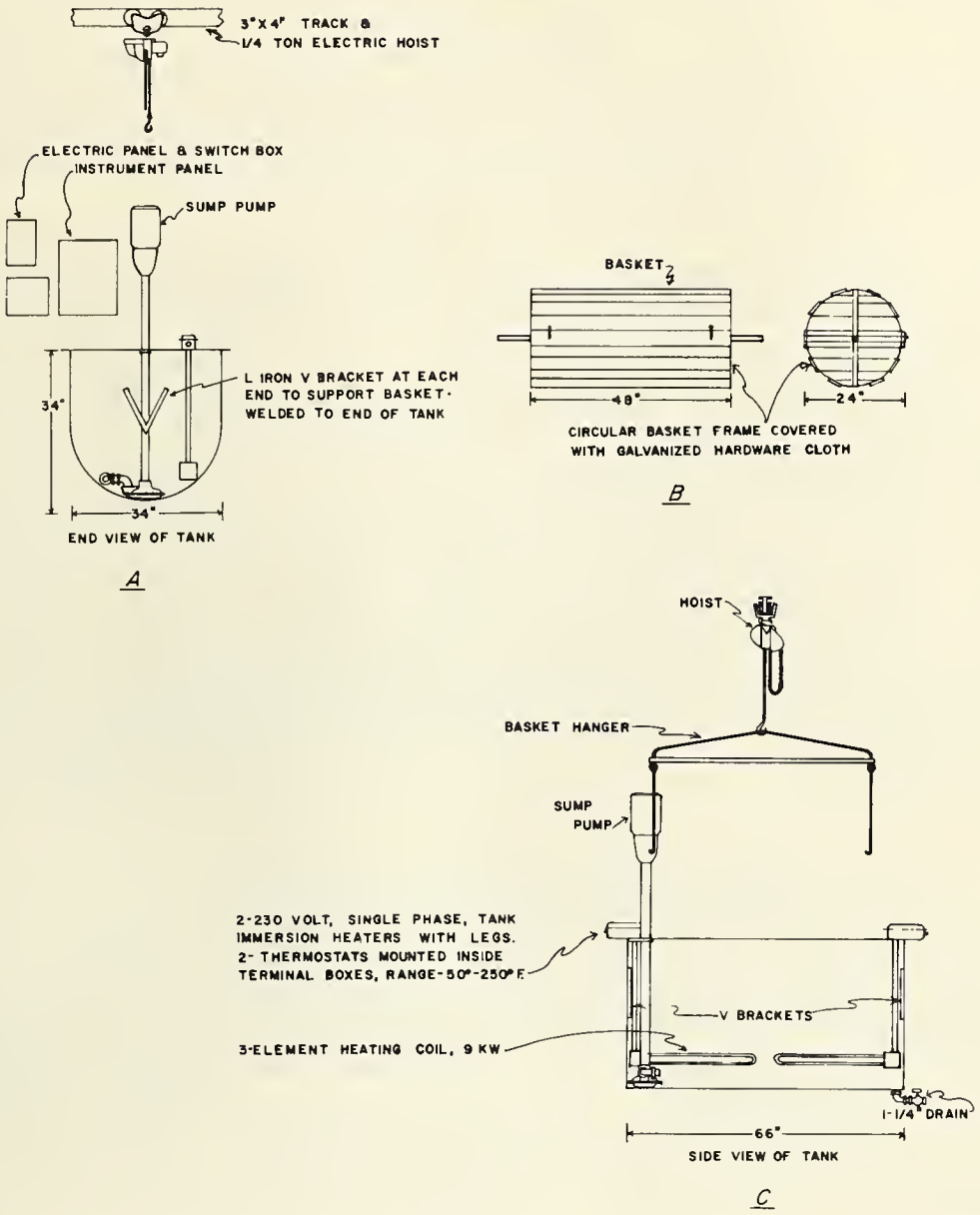

Figure 3. Design of the electric hot-water treater for ratoon stunting disease control at Canal Point.

This treater has been used as a guide for the construction of larger units now in operation in Florida. Electricity is used as a source of heat for the unit; however, a similar treater could be constructed to utilize steam.

If accurate temperature control could not be accomplished with steam, electrical resistance elements could then be used during the period of treatment to maintain a constant temperature.

The treatment tank shown in Figure 3 is made of 1/8-inch plate steel. It is closed in by concrete blocks. Sheets of slate, marine plywood, or other light material have been used to cover the tank. At Canal Point a cover is used when heating the water to the treatment temperature or while the unit is not in use. The tank usually is not covered during the treating period. When necessary, the tank is drained by a 1-1/4-inch drain located at one end of the unit (Figure 3, C).

Figure 3 shows the electric hoist, basket hanger, and track that raises the basket (Figure 3, B) and lowers it into the treatment tank. The basket rests on the V-brackets (Figure 3, A). The electrically driven sump pump (Figure 3, A and C) vigorously agitates the water in the tank, assuring equal distribution of heat throughout the tank. The heating elements with thermostats (Figure 3, C) are located at each end of the tank. Each element is controlled separately by an electric panel and switchbox. After the treatment temperature is reached, only one element is necessary to maintain a constant temperature. The instrument panel (Figure 3, A) houses a thermograph recorder and temperature indicator. The thermograph recorder is extremely valuable because it gives a complete record of the temperature in the tank during the treatment. The temperature indicator is used to determine whether or not the recorder is functioning properly.

GERMINATION FOLLOWING TREATMENT

The germination of cane following the hot-water treatment for the control of RSD at Canal Point has been satisfactory in seed increase plots. To be sure, some varieties of sugarcane are more sensitive to the hot-water treatment than others. In sensitive varieties one may encounter losses in germination of treated seed cane. As a whole, however, most of the commercial varieties are tolerant to the hot-water treatment; and when seed cane is treated properly, satisfactory stands of cane result.

OTHER ADVANTAGES OF HOT-WATER TREATMENT

According to Edgerton (3) and Hughes and Steindl (6), in addition to the control of RSD, hot-water treatment will also control such diseases as sereh, chlorotic streak, and downy mildew. The latter two diseases are especially important in the production of sugarcane in certain countries where RSD also is a serious problem. Various insect pests of sugarcane likewise are eliminated from seed pieces of hot-water-treated cane; for example, the sugarcane borer, the West Indian mite, and other insect pests

of the stalk. Moreover, a hot-water treater can be used to give healthy seed cane the stimulation treatment of 52°C. for 20 minutes which enhances germination. This treatment has been a commercial practice in Hawaii and other countries.

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